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Increasing Efficiency of Thermal Power Plant with the Help of Solar Energy

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***Abstract:** In today's world, electricity is mostly generated from steam power plants that use water as its main working fluid; water being abundantly available on earth. Solar energy is one of the most available source of renewable energy and could be used to increase the effectiveness of steam power plants. This paper establishes that the efficiency of a steam power plant can be enhanced by integrating solar energy to increase the temperature of the feed water entering the boiler. As a result, the amount of fuel needed to heat the feed water inside the boiler to produce steam is reduced.*

I. INTRODUCTION

Electrical power crisis is a big issue in the whole world. Moreover availability of fossil fuels such as coal, oil and natural gas is decreasing day by day and generation of power is also decreasing. At present with less availability, the cost of the fossil fuel is being increased which is creating a bigger problem as well. As the availability of renewable energies such as solar, wind, biomass, and hydro is plenty, it will be wise to use these energies more instead of fossil fuels or together with fossil fuels. Renewable energy is naturally replenished energy which comes from natural resources. Solar thermal power is the best prospective renewable energy resource [1]. Still many nations rely on non-renewable fossil fuels and nuclear fuels to generate electricity. But interest in renewable energy sources is growing as fossil fuels are running out and awareness is growing through general people about the negative impact of burning fossil fuels on the environment. Power generation is becoming increasingly costly and environmental pollution is becoming a concerning issue. In this paper proposal is given to integrate solar energy with our existing power station to increase the efficiency with reduced fuel cost.

II. CONCENTRATED SOLAR POWER

Solar power systems use the sun's rays solar radiation as a high temperature energy source to produce electricity in a thermodynamic cycle. The need for Concentrating Solar arises because solar radiation reaches the Earth's surface with a significant density (KW/m2) that is adequate for heating systems but not for an efficient thermodynamic cycle for electricity. So, the density has to be increased. Concentrating Solar Power (CSP) systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam. A wide range of concentrating technologies exists; the most developed are the parabolic trough, the compact linear Fresnel reflector, the parabolic dish and the solar power tower. A concentrating Linear Fresnel Reflector (CLFR) – also referred to as a Compact Linear Fresnel Reflector - is a specific type of Linear Fresnel Reflector (LFR) technology. Linear Fresnel Reflectors use long, thin segments of mirrors to focus sunlight onto a fixed absorber located at a common focal point of the reflectors. These mirrors are capable of concentrating the sun's energy to approximately 30 times its normal intensity [3]. The heat produced by concentrated sunlight may be used as a heat source for a conventional power plant which is discussed in this paper. Compact Linear Fresnel Reflector (CLFR) concept is appropriate for large scale solar thermal electricity generation plants as the temperature obtained from the concentrated sunlight may be 3200 C [2].

III. STEAM POWER PLANT

Steam Power Plant is a Thermal Power plant where water is generally converted into steam at high temperature to rotate the steam turbine at a required rpm to generate electricity. To convert mechanical energy to electrical energy a Steam Power Plant consist of many components, mainly boiler, low and high pressure turbine, re-heater, super heater, condenser, feed water pump, feed water heater, economizer etc. In a steam power plant air from the atmosphere is heated in preheater by flue gas to increase the thermal efficiency of the process. The heated air and fuel are supplied to the boiler for combustion where water is boiled to steam and superheater increases its temperature to eradicate moisture. Required steam is then passed to high pressure steam turbine where it is reheated and again passed to the low pressure turbine where it is connected with alternator for generating electricity. The condenser absorbs steam and it is transformed into water which is passed to the feed water heater to economizer to prepare water for reuse and

send to the boiler for cycle continuation.Generally thermal power plant works on principle of Rankine Cycle shown in Fig. 1 [5]. The cycle consists of four processes: (1-2) Isentropic compression in pump;

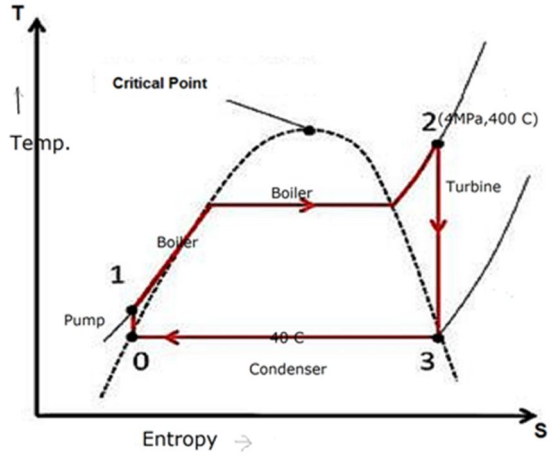

Fig. 1 Ranking Cycle

(2-3) Constant pressure heat addition in a boiler; (3-4) Isentropic expansion in a turbine; (4-1) Constant pressure heat rejection in a condenser. To improve this cycle some factors can be considered like lowering the condenser pressure, superheating the steam to high temperatures, increasing the boiler pressure, reheating Rankine cycle or by using regenerative Rankine cycle where feed water is heated by extracted steam from turbine [5].

IV. CONCLUSIONS

Electrical power generation is a big issue all over the world and with increasing demand of power generation, only depending on fossil fuels and nuclear power plant would not be a wise idea. We have to take advantage of every possible resources that are available to us. The proposal we have given here is for long term basis and we believe though the initial cost of building the whole system will be expensive but in future the profit gained from the increased efficiency and reduced environmental pollution will be much higher than the present high cost.

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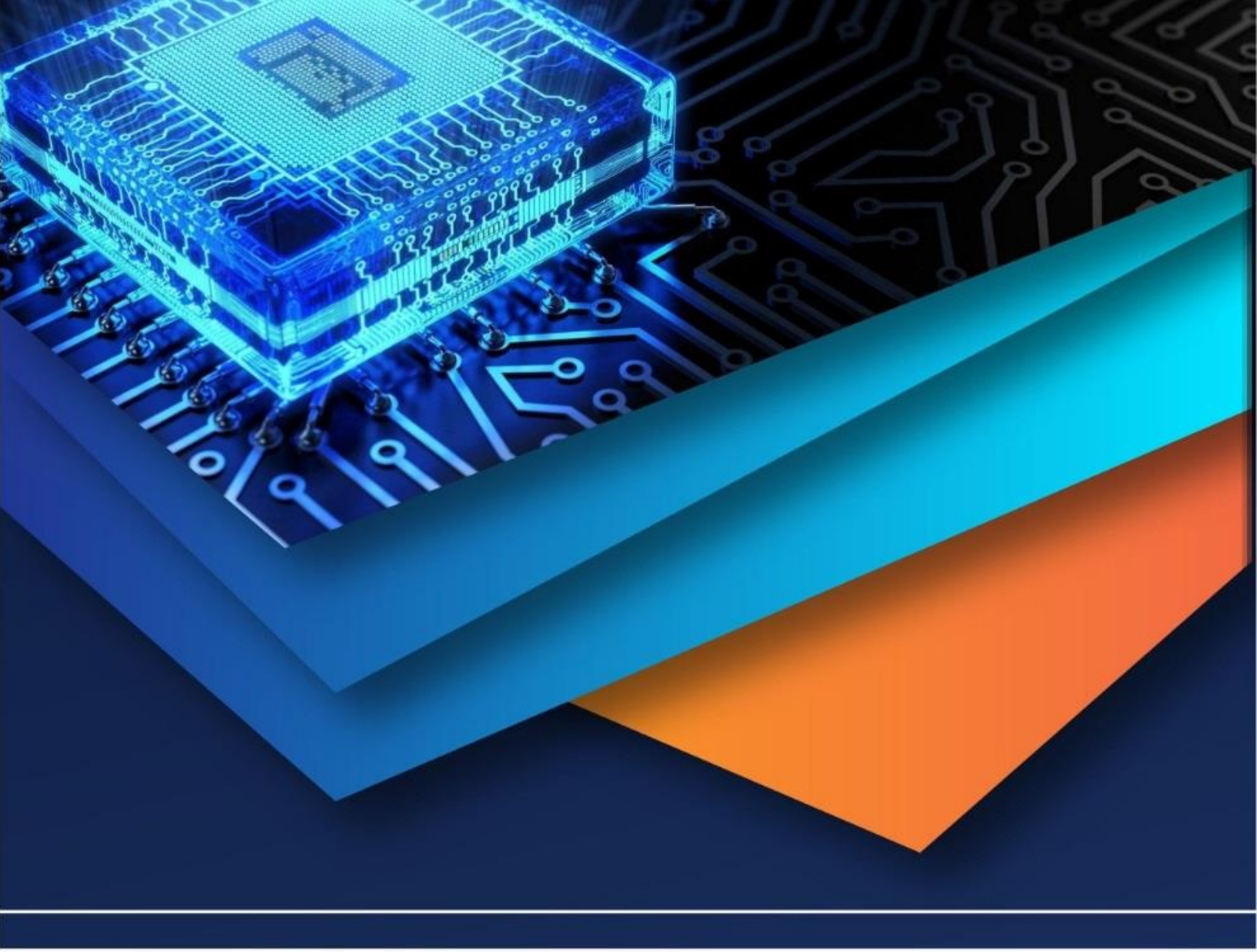

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